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CIVILIAN RESERVE AIR FLEET:

SHOULD THE USAF USE IT ROUTINELY?

A Research Paper

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by

Major Jerry D. Harris Jr.

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Disclaimer

The views expressed in this academic research paper are those of the author(s) and do not reflect the official policy or position of the US government or the Department of Defense.

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Preface

This research paper has been in my thoughts since the first use of the Civil Reserve Air Fleet (CRAF) in Desert Storm. USAF airlift capabilities are deeply routed in our use of civilian equipment and contractors. The CRAF ideas were developed in the early 1950s, but it was not actually used until 1990. Forty years of planning and preparation paid big dividends in the Desert Shield build up. Although there were minor setbacks, the combined military and civilian effort was a resounding success. So my thinking has been along the lines of why haven't we continued to employ this combination in a more robust environment to ease the burden on the military airlifters (people and equipment) and save money while we are doing it?

Special thanks is given to Maj. Bret "BG" Rider. His extensive C-130 background provided great insight into this topic and helped develop my research skills to gather and disseminate this information. LTC Wes Routh, HQAMC/DOF, provided the foundation for current CRAF guidance and AMC techniques for improving relationships with CRAF providers.

Abstract

First used in Desert Shield and Desert Storm, the Civilian Reserve Air Fleet (CRAF) program supplemented the USAF strategic airlift capabilities. The first ever use of resources the CRAF was a resounding success and only minor changes have been recommended to further improve the program. Would routine and continuous use of the CRAF improve USAF airlift capabilities during the current drawdown?

This essay will study the current and planned future of airlift capabilities and how this could be supplemented or replaced by use of civilian. A comparison will be made for: Continuing with the current policy to use the CRAF only during national emergencies, or Using CRAF to supplement USAF on a routine basis. This comparison will address the economic issues, the effectiveness of strategic airlift mission support, and whether this change would hinder USAF abilities to meet long-term global challenges.

Chapter 1

Introduction

> *To protect and advance U.S. interests in the face of the dangers and opportunities outlined earlier, the United States must deploy robust and flexible military forces that can accomplish a variety of tasks…*
>
> —William J. Clinton, President

Global Reach, Global Power, taking the fight to the enemy while drawing down the military and shrinking the defense budget, may require some thinking and acting outside the box. The idea of a Civil Reserve Air Fleet (CRAF) began in the early 1950s, yet we are still trying to determine the best way to employ the CRAF. There is a push to privatize anything within the military that can be done by civilian assets. Current commercial aircraft can do much of what USAF airlift aircraft are capable of, with the exception of cargo that does not fit on a standard size pallet. A case can be made that these civilian assets can even do much of this job at a lower price than USAF airlifters. This paper is not about replacing USAF airlifters with civilian companies, but provides the framework for better use of current assets available to the USAF.

Routine and continuous use of the CRAF would enhance the ability to accomplish the airlift mission, in support of USAF core competencies, especially Rapid Global Mobility and Agile Combat Support. Routine and continuous use of the CRAF is contrary to current guidance. The remainder of this chapter is devoted to the initial design and

objectives of the CRAF, followed by the significant changes that led to the first (and so far only) use of the CRAF, in support of Desert Shield/Desert Storm (DS/DS).

USAF strategic capabilities and limitations will be discussed in chapter two, followed by CRAF capabilities and limitations in chapter three. Chapter four provides a comparison of both USAF and civilian assets and how they may be combined synergistically to dramatically improve strategic airlift capabilities of the United States armed forces. The final chapter re-addresses the routine and continuous use of the CRAF to benefit both the military strategic airlift capability and provide the incentive for the civilian companies to continue to support the CRAF.

Background

The US Defense Production Act of 1950 provides the legal basis for the President to allocate industrial production and services to the Department of Defense during a national emergency.[1] One of the main reasons for CRAF development was the limitations of military airlift during the Korean war. Military Air Transport Service (MATS) was the agency in charge of providing the airlift for that conflict. They had the ability to negotiate contracts during the war. "These contracts were negotiated and re-negotiated at intervals during the emergency period as requirements dictated."[2] Not only were rates up for negotiation, but civilian companies could discontinue their support, which would seriously affect the airlift capabilities.

Early negotiations were confusing and very limited, since they involved classified airlift capabilities. Civilian companies were not given much information to base their approval, or disapproval, on the early planning of the CRAF. Airlift needs remained

flexible, since different national emergencies would require different airlift capabilities. Leaders recognized that future conflicts would require great mobility and possibly get very little notice to begin deploying troops and equipment. Mobilization of a portion of the civilian aircraft at that time would require a Presidential Executive Order, even then it was considered a mobilization, not a "militarization" of the civilian aircraft.

There are three segments of the CRAF. First is the international segment, which is centered around the strategic airlift requirements of the National Military Strategy (NMS). The other two segments are aeromedical evacuation and national (domestic and Alaskan), which will not be discussed further do to their limited effects on strategic airlift.

Although the particular aircraft that were to be mobilized at the time are different than current aircraft, the time allowed to convert them for CRAF use has been modified to 24 hours for Stage I and II and 48 hours for stage III (and aeromedical evacuation) aircraft. All aircraft to be used in CRAF employment were to be "long-range" four-engine aircraft.

War planners foresaw a fairly constant need for augmentation with some requirements for surge support.[3] The initial thinking was on the lines of a two stage process, one for continuous use (during the national emergency) and one stage for surge requirements. There were also plans for reservists to be called up to augment the airlines, which fell in line with national emergency procedures. The initial intentions of mobilizing the CRAF have not changed much over time, even after Desert Shield/Storm. CRAF mobilization is to be initiated only during a national emergency.

The airline fleets were subject to large turnover of aircraft, new aircraft were purchased and older ones were sold to foreign operators. Accidents also effected the number and types of aircraft available for CRAF use. As the fleet of available aircraft

changed, it became apparent periodic reviews of available equipment and military needs were needed. In April, 1953, one of these reviews determined that the CRAF should be able to draw from a Contingency Reserve Fleet, this led to the demise of the two stage process.

Airlift requirements changed significantly in 1962, when a larger amount of passenger support was required. This provided the carriers the opportunity to expand and modernize their fleets, so they began to pursue more government business.[4] There were even attempts by many civilian advocates to allow the commercial air fleet to do the majority of the airlift work, military airlift aircraft would be used as a reserve for the national emergencies. This proposal, in essence is the opposite of what we have today. This particular argument or proposal did not survive very long.

In an integrated plan, MATS provided civilian carriers the ability to modernize their fleets by making CRAF participation profitable. This provided the incentive to build and purchase aircraft that met CRAF requirements. The airlines used this start as a spring board to our current status as world leaders in production and use of modern civilian aircraft.

During this stage of CRAF development, it was an all or nothing deal. To use any portion of the CRAF, the entire entity would be activated. Obviously this would have a large fiscal impact if only a portion of the CRAF was needed. MATS pressed for an incremental mobilization of the CRAF, dependent on the size and degree of the national emergency. This led to our current three stage mobilization that we have now, but there were still some irons in the fire that needed tending.

Problem areas

Many of the problems that were foreseen during the formative stages in the 1950s still haunt us today. Some of the problems, like the availability or information versus security of airlift limitations, have been solved. The first use of the CRAF proved that not all the problems have been tackled, which fueled concerns for both sides of the fence.

Initial concerns of militarization were voiced by the civilian companies. The cold war era was just beginning and many companies wished to avoid increased military control. Legislation soothed the fears of militarization and the incremental call up ability allows the right number of assets to be obtained for each situation.

A concern among the military is the loss of indigenous airlift ability, with increased reliance on the CRAF. Today we use civilian aircraft to meet the daily needs of strategic airlift, easing the burden on the USAF strategic airlift assets. This does not lessen the value of Air Mobility Command (AMC) assets, nor provide fuel to any fire that may wish to further reduce military airlift capabilities.

Centralized control, decentralized execution concerns are solved through the USTRANSCOM organization. This is the controlling agency for all strategic lift assets including strategic airlift. Initial advocates of the CRAF planned to superimpose military organizational structures over the civilian assets, but this would be unwieldy and most certainly increase the costs of the CRAF.

Contractual problems are a constant irritant, striving to seek a balance between a profitable business for the civil carriers and still meet the needs of the military. To be eligible for CRAF service, most older aircraft had to be modified. Many of the carriers committed aircraft, but then drug their feet in preparing the aircraft for service. Aircraft

were exchanged throughout these early years with other countries and companies, so it was hard to keep the few modified aircraft assigned to the CRAF.

During the design and development of the C-141 in the mid 1950s, government officials hoped that civilian companies would voluntarily select the C-141 for civil operations. This would have been a great option for the military side of the CRAF, providing essentially the best airlift aircraft with no modifications required to air carriers. No civilian companies selected the C-141 option for use and air craft modification and design continued to be an issue.

Security was a previously mentioned problem, but providing security clearances to the contractors was not the solution to all the security problems. The civilian companies had to know some of the airlift limitations to better provide service to the government. Once this hurdle had been cleared, more security issues jumped into being. Actual air carrier employment meant use of all airline employees. Many of the carriers hired indigenous personnel from the countries in which they operated. This meant foreign nationals would be involved in airlift operations during national emergencies, the military balked at this situation.

Manpower was and is another issue. The civilian crews operating the air carrier aircraft did not have to participate in the CRAF mobilization, security of the crews was questionable. Would a potential enemy recognize and honor the status of civilian non-combatants under the Geneva convention?[5] DS/DS raised the protection issue with the Iraqi Scud threat and the threat of weapons of mass destruction (WMD). The sheer number of aircrew available to fly the long and demanding strategic missions was foreseen as a limitation. However, as the air carriers grew in size, this problem declined. Early

augmentation plans required extra aircrew training on military equipment. This problem extinguished itself as modern civil aircraft have kept up with or outpaced military avionics for navigation.

The size of the civil air carrier fleet also posed a few problems. Even a modest activation would have had serious implications on the economic survivability of the airlines. Routes lost (to non participating air carriers) could severely weaken the companies that supported the CRAF.

As the air carriers and the USAF matured, most of these problems were addressed and continue to be addressed. Desert Shield/Storm provided an opportunity to activate the CRAF and the results were better than many expected. Obviously there were (and still are) some problems that needed to be rethought, but the mobilization proved to be a success. These issues have led to our current CRAF implementation guidance, which follows.

Current CRAF Policy

The CRAF is to be used only in a national emergency! Stage I involves the use of limited assets, for both passenger and cargo, and can be activated by the Secretary of Defense. Stage II requires Presidential authority and is designed to provide greater support to national emergencies less than all out war. Stage III requires a declared national emergency (Presidential) and then the Secretary of Defense may specify what portions of the entire fleet of US commercial assets for maximum augmentation.

President Reagan signed the National Airlift Policy in 1987, this reinforced the US military plan to use commercial carriers whenever feasible and suitable. "The policy is to

fly military aircraft during peacetime the minimum necessary to maintain the military readiness and training and to rely on civil carriers to meet the remaining airlift requirements where possible."[6] To meet this Presidential goal, the Transportation Command (TRANSCOM) currently engages civilian air carriers in negotiations for shipment of military cargo and passengers.

The two nearly simultaneous Major Regional Conflict (MRC) requirement will put a huge burden on the airlift forces. To execute the two MRC strategy, we plan to fully engage the CRAF. From a tactical perspective, a combatant unit will fight the way they train, so it trains the way it wants to fights. Applying this logic to airlift requirements would seemingly point to regular use of the CRAF.

Comparison

This discussion will not degenerate into an aircraft comparison, civilian versus military, but will stay focused on the capabilities of the military or civilian system that is being discussed. To start the process of comparing the systems, two measures of capabilities must be understood. The most common measurement of cargo capacity is million ton miles per day (MTM/D). This is a simple comparison that takes into account the utilization rate of an aircraft, the average speed and average payload weight to provide a figure of how much can be moved for comparison purposes.

Possibly, a more accurate assessment is a measurement of throughput. Consider two aircraft with equivalent MTM/D capabilities, but one is considerably larger than the other. A typical airfield may only support three of the larger aircraft or four of the smaller aircraft. Obviously the smaller aircraft would be the preferred asset. Throughput

calculations provide the planner with the capability of a specific aircraft for a given airfield. This comparison can be used to compare different aircraft at the same airfield or to compare different airfield capabilities with given aircraft assets. Table 2 in Appendix 1, lists many pertinent statistics of military and civilian cargo aircraft, to include MTM/D and throughput comparisons.

The thesis of this research paper asserts that routine and continuous use of the CRAF would improve the overall US airlift capability. The next two chapters lay the foundation of the military and civilian strategic airlift capabilities and limitations. Once this foundation has been laid, a solution will be proposed for the best mix of military and CRAF assets to meet our future challenges.

Notes

[1] Routh, John W., LtCol, USAF, Deputy Chief, Civil Air Division, Directorate of Operations, HQAMC. "Introduction To The Civil Reserve Air Fleet." Briefing notes, August 1996, page 4.

[2] May, Bedford D., LtCol, USAF. "The Development of the Civil Reserve Air fleet by the Department of Defense, an Analysis." Thesis number 2555. Maxwell AFB, AL: Air War College, February 1964, page 2. LtCol May continuous on this path of negotiated contracts that may hamper the "instant readiness" of the military.

[3] Ibid., page 6. This initial planning led to the CRAF being designed in two parts, one the would be used continuously during national emergencies and one that would be used as required during national emergencies.

[4] Ibid., page 45. In the early stages after the Korean war, military airlift was drastically reduced and the business was being given to commercial carriers.

[5] Ibid., page 32. Even the early days of civilian augmentation planned for these carriers to fly to major terminals in rear areas, but the problem could present itself, under certain circumstances.

[6] Routh, John W., LtCol, USAF, Deputy Chief, Civil Air Division, Directorate of Operations, HQAMC. "Introduction To The Civil Reserve Air Fleet." Briefing notes, August 1996 page 4.

Chapter 2

USAF Strategic Airlift Capabilities and Limitations

> *When this nation responds, mobility forces are no longer merely support forces. We use these aircraft to project influence. When those aircraft are sitting on a ramp in some far away country with that American flag on the tail they are not representing the United States of America, the are the United States of America.*
>
> —General Ronald R. Fogleman, CSAF

"**Rapid global mobility** is the timely positioning of forces through air and space, across the spectrum of military operations."[1] The USAF military airlift fleet was designed and built for the primary use of military mobility. This fleet was developed with assets that can handle large equipment and rapidly on and off load cargo using a roll on, roll off (Ro-Ro) style. During and before the early 1990s, strategic airlift capabilities were centered on the C-141B Starlifter.

Considered the workhorse of the Air Mobility Command, the C-141 can carry troops and/or cargo. The C-5 Galaxy aircraft is larger and has the ability to carry oversize and outsize cargo. The C-17 Globemaster III is currently being procured as a replacement to the C-141 which first flew in 1964. The numbers of airframes and the aircraft statistics are listed in Table 1.

Table 1. Aircraft Available

Aircraft	Feb 97	2008
C-141B	184	0
C-5B	104	104
C-17	23	120
KC-135	442	442
KC-10	54	54

Source: Wetzel, Mark R., Maj, USAF,USTRANSCOM, Operations and Logistics Directorate, briefing, February 1997.

There is a gap in the information provided in Table 1, where there may be an increased reliance on CRAF assets, even under the current plan. The last active duty C-141 is to retire in the year 2003, with the last C-17 being procured in 2008.[2] This is a temporary situation that will not be further addressed.

Capabilities

A majority of DOD cargo is typical cargo that can be palletized for ease of movement and bulk shipping. This general type of cargo makes up a large portion of airlift cargo. There are some items that are considered not to be air transportable, due to the size, volume or weight of the cargo. Oversize cargo and outsize cargo (see glossary) are cargo that is air transportable, but will not fit on a standard pallet. In general, to move this type of cargo, an aircraft must be equipped with very large openings which allow for the equipment to be loaded. While the cargo itself may fit inside of an aircraft, getting it through the cargo door may be a problem.

The AMC airlift aircraft have the unique ability to move oversize and outsize cargo, such as an M1A1 tank or a Patriot battery. KC-135 and KC-10 aircraft have limited oversize capability and no outsized cargo capability. Military aircraft that have been

developed specifically for cargo movement (C-141, C-5, C-17) gain from roll on, roll off capability. These aircraft are able to quickly load cargo without special equipment, increasing throughput for the mission. All three aircraft have large doors in the back of the airplane so that cargo may be rolled (or driven) straight into the airplane. The C-5 has the ability to load and unload through the nose of the aircraft. This enhancement speeds the process to load and unload cargo.

While the inter-continental range of the C-5 and C-17 are impressive, the ability of all the strategic airlifters to refuel provides the customer with unlimited range options. Airlift operations for Desert Shield/Storm flew an average of 8,000 nautical miles.[3] For the military airlifters this average range relied heavily on an aerial refueling bridge.

While accomplishing it's primary mission of aerial refueling, the KC-10 is also an excellent strategic airlifter. When accomplishing a dedicated strategic airlift mission, the KC-10 is capable of carrying more bulk cargo than the C-141. KC-10 throughput is less though, do to the material handling equipment requirements associated with the very high main deck. The fuel capacity allows for extended range flights which is a benefit. This dual role capability of aerial refueling and airlift is of immense importance when moving certain combat units. While limited in numbers (54 total), the KC-10 is the primary support aircraft for strategically moving fighter squadrons. The KC-10 provides fuel to the fighters while also carrying cargo and passengers to the same destination.

Cargo is not the only airlift requirement for airlifters. Personnel must also be transported. Sometimes personnel are the primary mission and sometimes as a dual mission with cargo. All the military aircraft can be fitted with passenger pallets that provide "airline" style seating. While these pallets reduce the cargo capabilities, they

provide for a comfortable ride for the passengers. Troop or web seating can be provided down the sides of cargo aircraft without reducing the cargo volume. Although these seats are not as comfortable as the airline style seating, the additional capability is worth noting.

The C-17 and C-5 both can carry troops (102 & 73 respectively) on the flight deck without sacrificing cargo space. It is a great advantage to deliver the operators with the equipment. There are missions where passengers require more than typical seating.

The C-141 also provides a special mission for strategic airlift. Aero-medical evacuation, whether for a combat operation or a military operation other than war is a necessity. This mission requires special equipment onboard an aircraft for the support of the sick and injured. The C-17 has had this equipment built-in by design, so as it replaces the C-141, the capability will not be lost.

Strategic airlift usually requires a large airport that has long runways and lots of parking space. Once cargo is unloaded, it is moved to consumers using intra-theater assets. Ground transportation is common, but tactical airlift, usually C-130s routinely move cargo to the consumer. The C-17 has the ability to "direct deliver" cargo to tactical airfields, with it's short field take off and landing abilities. This minimizes the delivery time and reduces intra-theater lift requirements. Some cargo can be delivered with the use of LAPES (Low Altitude Parachute extraction) system. LAPES is an asset, but there are limited crews that are trained for this mission.

Limitations

While the capabilities of military airlift are immense, there are limitations. The first limitation covered will be the actual numbers of airlift aircraft needed to accomplish the

mission. The age of the airframes and the crew limitations will be discussed second, followed by the massive requirement demands for airlift.

While it is a significant capability to carry oversize and outsize equipment, airlift does have it's limits when it comes to moving large cargo. The sheer weight of a main battle tank, like the M1A1, limit current aircraft (C-17 included) to carrying just one tank at a time. The amount of strategic airlift required to move the 82d Airborne Division is staggering. It would take 1,010 C-141 sorties and 47 C-5 sorties just to move the equipment.[4]

Currently there are 311 dedicated airlift aircraft (C-141s, C-5s, C-17s), going down to 224 (C-5s and C-17s), so the number of tails available to meet the strategic airlift needs are decreasing. With the current budget plans, two C-17s will replace three C-141s. A strategic requirement for a single C-141 (13 or less pallets) will still require either a single C-17 or C-5 to accomplish the mission. The advantage for the C-17 is in the 14-18 pallet range, when two C-141s would be required to accomplish the mission, versus one C-17. Smaller requirements will have a tougher time competing for the fewer assets available in the near future. Today's principle of decisive force will require more assets than a single airborne division for a major regional conflict. Airlift will not do it all, but we may be able to improve the way we currently do business.

General Hansford T. Johnson, CINC USTRANSCOM, 1990, speaking about DS/DS said "at the height of our initial surge, more than 124 strategic airlifters were landing in the desert each day…that's one airplane every 11 minutes."[5] This placed a huge burden squarely on the back of the airlift fleet. The C-141 fleet maintained flight restrictions of 51,000 pounds maximum cargo weight, versus the planned 75,000 pound war capacity.[6]

C-5s operated at wartime maximum gross weight restrictions, and both airlifters are approaching planned service lives. Although modified, the C-141 fleet is over 25 yeas old and the C-5A fleet is 19 years old. The C-17s will be around for a while, but the C-5 will become nearly 50% of the airlift force, without getting any younger.

All of this flying time on aircraft also strained the aircrews that were flying them. Maximum crew duty days were stretched to 20 hours and the 30-day maximum flying time accumulation limits were increased from 125 hours to 150 hours.[7] Previous to DS/DS, airlift squadrons had been operating at an increased operations tempo. The airlift operations were strained further for the desert conflict, the majority of cold war planning had been for a European conflict and the Arabian Gulf was even farther away.

The National Military Strategy calls for a nearly simultaneous two MRC option. Prioritization of airlift assets becomes an even greater issue with a lesser amount of aircraft. Building an air bridge with tanker assets going in two separate directions may prove to be an insurmountable task. The range capabilities of military aircraft (see Table 2, Appendix A) may not be enough. As the C-141s drawdown, this problem will be minimized, but even the C-17 range of 5,200 NM may diminish strategic airlift capabilities when aerial refueling assets are not available.

While there are no doubts about the requirement for aircraft that are oversize/outsize cargo capable, the cost of this capability is staggering. The cost per ton-mile to move cargo with military airlift is not readily available, but by the time the procurement costs of the airlift aircraft are included into the operating cost equation, it is sure to be higher than the civilian freighter counterparts. This is an inherent limitation.

Notes

[1] US Department of the Air Force. *Air Force Executive Guidance*. Washington D.C., October 1996 Update, page 14.

[2] Air Force Home Page, USAF Fact Sheets, Available from http//www.usaf.mil, January 1997, C-141 and C-17 pages.

[3] Tefteller, William R., LtCol, USAFR. *Strategic Airlift Support for U.S. Forces Deployment to Operation Desert Shield*. The Industrial College of the Armed Forces, National Defense University, April 1991, page 5.

[4] *Army into the Twenty-First Century, The.* Maxwell AFB, AL:, Army Advisory Group, Air University, Air War College, February 1996, Page D-5.

[5] Tefteller, William R., LtCol, USAFR. *Strategic Airlift Support for U.S. Forces Deployment to Operation Desert Shield*. The Industrial College of the Armed Forces, National Defense University, April 1991, page 1.

[6] Bond, David F. *C-141s Fly Middle East Missions Despite Weight, Operating Curbs*. Aviation Week & Space Technology, 27 August 1990, pages 21-22.

[7] Tefteller, William R., LtCol, USAFR. *Strategic Airlift Support for U.S. Forces Deployment to Operation Desert Shield*. The Industrial College of the Armed Forces, National Defense University, April 1991, page 49.

Chapter 3

CRAF Airlift Capabilities and Limitations

> *The air and space capabilities we offer the national command authorities are in higher demand than ever. Our air mobility fleet allows us to respond to a wide range of contingencies—from airlifting troops and equipment during a crisis to delivering supplies after a national disaster.*
>
> —Secretary Sheila E. Widnall

Commercial carriers are in business to make money. To this military member, this seemed to be a drawback. How could a system that revolved around money provide the military anything for a fair price? As it turns out, this money fixation has forced the commercial carriers to hone their businesses to extreme efficiency in all respects. From interchangeable parts for different aircraft to maximizing training efficiency (operational commonality), civilian companies provide airlift capacity in the quantities needed and at an affordable price.

As aircraft manufacturers merge, declare bankruptcy, or continue as they are, their numbers are dwindling. Although not airline specific, this section will layout the capabilities of certain aircraft and companies that provide the majority of equipment for the CRAF. Appendix B lists the companies that provide the majority of the CRAF assets for passengers (and AE: aeromedical) first (Table 3) and cargo second (Table 4).

CRAF involvement requires that companies commit 30% of their long-range international fleet for passenger carriers and 15% for cargo carriers. All of the aircraft

committed must be registered in the US to ensure their availability.[1] To ensure the aircraft are capable of operating 10 hours per day (planned utilization rate), the companies are required to commit 4 crews per aircraft. The crews must be US citizens to satisfy security requirements.[2]

Capabilities

Not being able to air to air refuel (AAR) is a large drawback of CRAF assets. But what these assets lack in AAR, they usually make up for it in basic unrefueled range. The Boeing 747-400's range of 7,200 nautical miles allows for non-stop, unrefueled flights from London-Tokyo, Singapore-London and Los Angeles-Sydney.[3] The average DS/DS airlift mission was 8,000 nautical miles in length. The civilian aircraft could fly from the continental US into Europe, refuel and change crews. The aircraft would then fly onto Riyadh, unload the cargo/ passengers, then fly back to Egypt for servicing. The second leg of the trip (servicing at another base) allows for increasing throughput at the consumer point of debarkation (POD).

The efficiency of civilian aircraft allow for small aircrews (usually 2) and for cargo capacity equal or better to that of the C-5. These widebody aircraft can even double the pallet capacity of the C-17 (see Appendix A, Table 2). Large cargo doors on the cargo aircraft allow for standard size and some oversize equipment to be loaded. Note in Figure 1 that the new freighter versions even have nose loading cargo doors similar to C-5s, but they do not have the Ro-Ro cargo deck.

Source: Boeing 747-400 background/fact sheet (17 Jan 97)

Figure 1. Boeing 747-400 Freighter

The cruising speed of the civilian aircraft is very fast, when compared to military airlift aircraft. The Boeing 747-400 cruises at Mach 0.85 (600+ mph).[4] This decreases the time required to get the equipment or people into place. For a 4,000 NM flight, a 747 would take 7.8 hours to complete journey, while a C-5 (Mach 0.72) would take 9.3 hours and a C-17 (Mach 0.77) would take 8.7 hours. These time comparisons do not take into consideration the military cargo aircraft slowing down for aerial refueling operations. The high altitude cruising ability of civilian aircraft (Boeing 747: 41,000') allow for maximum fuel efficiency, which provides for the impressive 7,200 NM unrefueled range capability.[5]

The extended range of the civilian aircraft reduce the need for AAR operations. While being incapable and untrained for aerial refueling, the fact that the commercial assets do not require AAR assets helps ensure that KC-10s and KC-135s are available for other missions. Tanker aircraft not used for strategic movement of fighter aircraft are used to extend the range of the strategic airlift fleet. CRAF use reduces the load on the AAR fleet. They can then be used in a strategic airlift mission, for which the KC-10 is an excellent platform.

Since the civilian airlift aircraft are based on already proven commercial aircraft, the development costs are already accounted. The similar construction of these aircraft also allow them to be converted into passenger aircraft with seating, in some, in excess of 400

passengers. There are also a few newer versions of civilian aircraft that are dual role capable, carrying both passengers and cargo.

One of the best capabilities of the CRAF companies is their ability to move cargo at a relatively cheap price. Category B cargo, a full plane load, is $0.27585 per ton-mile for round-trip cargo. One way cargo is $0.51032 per ton-mile. Category A cargo (full pallets, not full aircraft) is $0.51032 per ton-mile.[6]

The vast experience of the civilian aviators is also a capability that can be used during CRAF implementation. Many of the air carriers routinely fly to installations that military crews visit infrequently. The knowledge transfer from civilian to military aircrew may provide location specific information. This information may have been only a planning assumption previously. Many of the civilian aviators also have prior military flying experience. This facilitates the coordination of the two entities.

Limitations

While current CRAF capabilities are almost 40% of the military strategic airlift capabilities,[7] there are many drawbacks to the use of civilian aircraft for military purposes. First and foremost is the political decision for these aircraft to fly into a combat zone. Obviously, they will not fly into enemy territory, but there are inherent risks, even when flying to rear area bases. Ballistic missile threats and the possibility of enemy special operations forces (SOF) incursions could hinder the CRAF ability to operate. The public and political uproar that would follow the downing of a commercial aircraft, being used for military purposes must be considered. Once the decision to employ the CRAF is made, there are still obstacles that must be overcome. Some of these problems were seen

in DS/DS and overcome. Of particular note was the issue of chemical warfare equipment to the civilian aircrews. Although was a small point of contention, there are larger problems with use of civilian airlift resources.

Most outsize cargo and some oversize cargo is not capable of being transported by civilian aircraft, even the freighter designed versions. Although the large cargo door allows for some oversize cargo to be transported, the proximity of the main deck to the ground requires special material handling equipment for most civilian aircraft to be loaded. This decreases the throughput capability of the aircraft and requires preparation to ensure that the right equipment and maintainers are available at the correct locations for loading and unloading.

This preparation must also consider the distance the aircraft must fly. Civilian aircraft are not AAR capable. Extremely long distances will require stop-over airfields that are equipped and maintained to handle the large aircraft. Depending on the length of the flights into and out of the stop-over locations, additional aircrew may also be required. Whether these extra aircrew will be aboard the aircraft or billeted at the stop-over base will depend on the specific airfield location and the individual companies.

The volunteer system of the current CRAF has drawbacks. Whereas a military commander can give a legal order and take responsibility for deviating from regulations, the same may not be true of civilian aircrews. DS/DS CRAF implementation also showed some limitations of the civilian bureaucracy. At least some of the airlines had not included CRAF provisions in their existing labor contracts[8]. The Airline Pilot's Association (ALPA) raised several issues about the extended range flights. Dealing with civilian companies means unions and other agencies will get involved with the operation.

One final limitation that must be discussed is the loss of civilian business for the air carriers that participate in the CRAF program. CRAF provides nearly 40% of all airlift capabilities when fully activated. The US Armed Forces rely on airlift for MRCs and other contingencies, so in essence we are relying on the assumption that these carriers will be there when needed. Unlike the military, these companies are in the business to make money. Good business sense dictates that the companies must be paid well enough to cover operating costs and be able to sustain a profitable bottom line. While in the short run this is a limitation (higher costs to the DOD), in the long run, the military users will be able to tap into the companies civilian resources.

Current CRAF activation pulls civilian assets out of their commercial obligations, allowing for other carriers (possibly not CRAF supporters) to gain a larger share of the market. This encroachment obviously effects companies that fully support the CRAF much more than those that do not. After the DS/DS activation, CRAF enrollment decreased while the companies sought to regain their market share[9]. This serious issue must be addressed as a risk within the company management, prior to volunteering CRAF assets.

Notes

[1] Routh, John W., LtCol, USAF, Deputy Chief, Civil Air Division, Directorate of Operations, HQAMC. "Introduction To The Civil Reserve Air Fleet." Briefing notes, August 1996, page 21. The notes go on to mention that foreign aircraft are not permitted, since many foreign aircraft manufacturers are subsidized by their government and their availability could be influenced by government political decision.

[2] Ibid., page 21.

[3] Boeing 747-400 background/fact sheet (17 Jan 97). Available from http://www.boeing.com, page 1.

[4] Boeing Specifications: 747-400, 747-500X and 747-600X (17 Jan 97). Available from http://www.boeing.com, page 2.

[5] Ibid., page 2.

Notes

[6] Routh, John W., LtCol, USAF, 14 February 97.

[7] Routh, John W., LtCol, USAF, Deputy Chief, Civil Air Division, Directorate of Operations, HQAMC. "Introduction To The Civil Reserve Air Fleet." Briefing notes, August 1996, page 7.

[8] Tefteller, William R., LtCol, USAFR. *Strategic Airlift Support for U.S. Forces Deployment to Operation Desert Shield*, the Industrial College of the Armed Forces, National Defense University, April 1991, page 69. Other issues addressed by ALPA included extended duty days and increases to the maximum number of flight hours per month.

[9] Routh, John W., LtCol, USAF, Deputy Chief, Civil Air Division, Directorate of Operations, HQAMC. "Introduction To The Civil Reserve Air Fleet." Briefing notes, August 1996, page 33.

Chapter 4

The Best of Both Worlds?

> *The essence of aerospace operational art is the planning and employment of air and space assets to maximize their contribution to the combatant commander's intent.*
>
> —Air Force Manual 1-1

Currently, in times of national emergency, the United States does not differentiate between the military airlift capabilities *OR* the civilian capabilities. The ability to use both at the same time allows for the greatest flexibility, while maximizing mission accomplishment. This chapter will compare the previous chapter's capabilities and limitations, prior to drawing conclusions about the ability to use the CRAF on a continuous and routine basis.

Figure 2 (next page) is a simplified graph of our current use of civilian assets. Scheduling of civilian assets is done through USTRANSCOM, on a negotiated basis. Factors influencing which carriers get the business include carrier capabilities and CRAF participation. This program is currently used as the primary incentive to keep carriers voluntarily enrolled in the CRAF.[1] Excess airlift is portioned out to the CRAF members that volunteer to fly peacetime DOD airlift missions. The negotiated price for this airlift is based on operational expenses of carriers that receive $5 million per year of AMC contracts.[2] These contracts are updated yearly and set the payment rate for both

peacetime and emergency usage. As Figure 2 shows, the amount of excess airlift varies from day to day for typical operations.

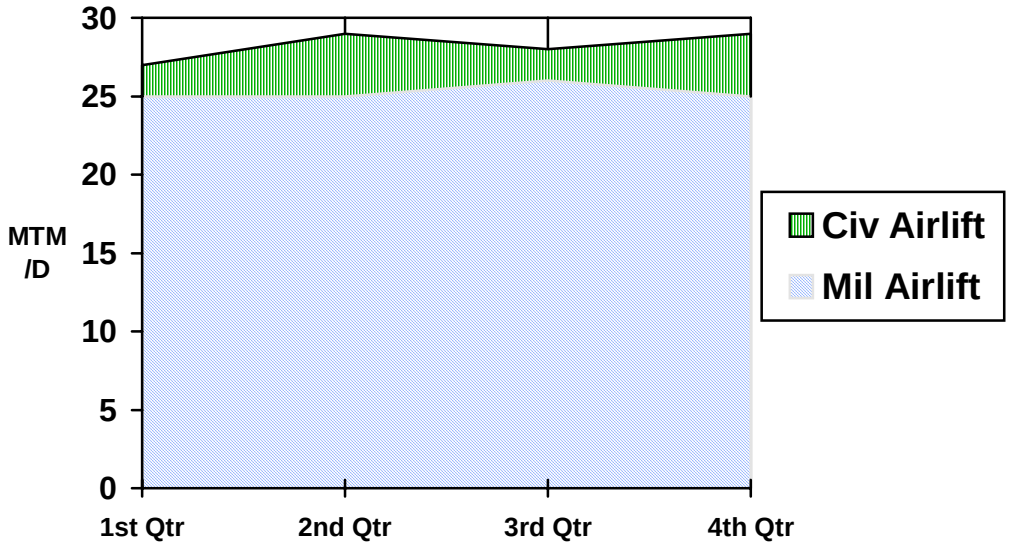

Figure 2. Typical Airlift Use

This paper proposes a very different way to employ civilian assets. Rather than portioning out airlift requirements that are not met by the military, why not "activate" the CRAF (a portion of stage 1?) for a set amount of airlift each day. Figure 3 (next page) shows this different approach, in a simplified manner. Rather than schedule civilian assets for excess airlift, schedule a set capacity for routine and continuous use, then have the military airlift accomplish the remaining requirements.

This method of employment would provide a regular amount of volume (cargo and passengers) to the CRAF suppliers. The proposed routine and continuous use would be at a higher volume than the average "excess" volume currently scheduled. The military airlift would then accomplish the remainder of the airlift requirements, less than current

conditions. The proposed condition helps accomplish the objectives of the 1987 National Airlift Policy, "using military aircraft the least amount possible."

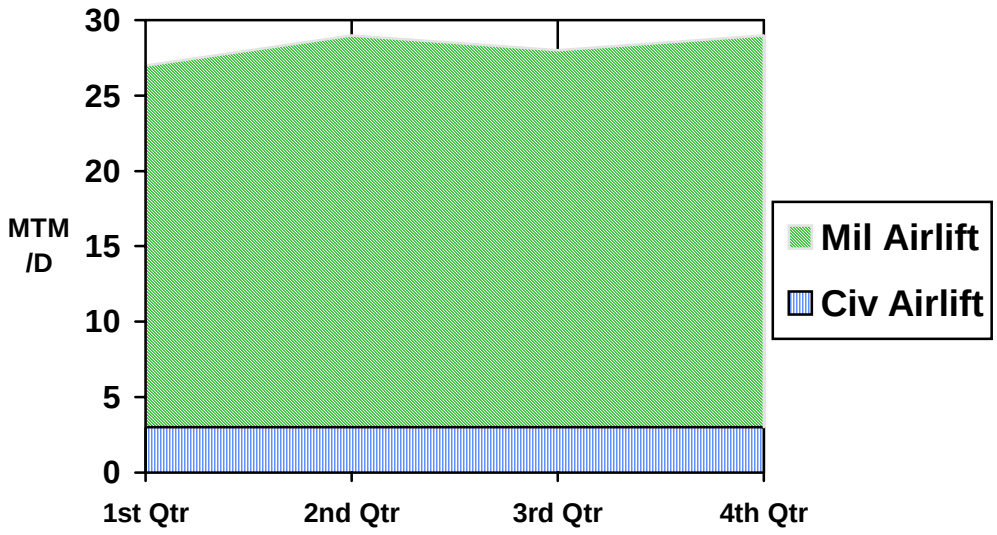

Figure 3. Proposed Use of CRAF

Military Benefits

Use of military airlift assets will be reduced, decreasing the operations tempo that has strained our airlift forces for the past decade. The reduction also lengthens (in years) the life span of current and future hardware, since it takes longer periods of time to achieve the programmed flying hours on the equipment.

DOD costs will be less, since commercial operations operate at the negotiated price, presumably cheaper than organic military costs.[3] The military continues the yearly negotiated price currently in place and be able to provide better incentive to the CRAF companies. As air carriers see a stable peacetime use of their assets, the CRAF base may grow to include hardware specifically procured for CRAF operations. For example, say Federal Express provides two 747s for routine and continuous CRAF use and sees regular

use on DOD missions. Federal Express may then increase their fleet size to provide more aircraft for peacetime CRAF use, without effecting their civil operations.

This increase of assets provides for a larger resource base and minimizes the effect of lost market share during increased CRAF mobilization. The larger resource base benefits the US Armed Forces by providing increased surge operations capabilities.

During development of the C-141, possibility during the C-5 and even the C-17 development, Pentagon planners had hoped that civilian companies would purchase these "specialty" cargo aircraft, thereby reducing the costs per aircraft.[4] The proposed implementation plan would be the first step of civilian air carriers to begin to purchase assets primarily for DOD employment. Future military airlift designs should be compatible enough that civilian companies can earn a reasonable profit by purchasing similar aircraft. Although the civil air carriers may not "buy our airplanes," they may design and purchase aircraft that meet our needs and requirements.

Civilian Benefits

The current process of scheduling civilian airlift will change little, except for the volume stabilization. This stability provides a solid foundation for companies to increase their CRAF allocations and possibly their fleet size. The stable use of assets provides the companies with another market, increasing their business potential.

Based on routine and continuous CRAF use, future mobilizations of CRAF stages 2 and 3 will have a smaller impact on the CRAF supplier. With a portion of an air carrier fleet already employed in routine CRAF usage, an increased requirement will disrupt typical civilian operations with a smaller percentage of their fleet being effected. The first

reason for this is military airlift assets will be expanded to full capacity. The military absorbs some of the increased requirements surge. Secondly, if a company committed 30 aircraft to the CRAF, current procedures would be to activate all 30 aircraft (assuming all were needed). Considering routine and continuous use implementation, the same carrier may already have 3 or 4 aircraft in use with CRAF, thus requiring only 26 or 27 aircraft to be activated.

During the single use of CRAF, there were many lessons learned. Corrections are being made. Routine and continuous use of the CRAF improves coordination abilities of military (strategic or tactical users and strategic planners) and civilian assets. Improved coordination reduces the delays inherent in airlift missions, such as waiting for cargo to be prepared, waiting on aircraft servicing, etc.

Synergism

Flying only 20% of the airlift missions during DS/DS, CRAF assets moved 62% of the passengers and 27% of the cargo during the deployment phase. They moved 84% of the passengers and 40% of the cargo during the redeployment phase.[5] This obvious efficiency should not be used only during a crisis. Using the CRAF everyday, on a routine and continuous basis will enhance the strategic airlift capabilities of the United States.

Civil air carriers probably will probably never engage in large scale oversize or outsize cargo carrying. The delivery rates of 9.2 MTM/D for outsize cargo and 17.9 MTM/D of oversize cargo[6] must be met by the military airlift. Increased CRAF performance may allow for better strategic airlift. Aircraft like the C-17, capable of transporting outsize cargo, can make deliveries to the shooter, rather than to a logistically centralized airbase.

Implementation of routine and continuous use of the CRAF does not recommend reducing military airlift assets. There will not be an immediate cash flow windfall by using civilian assets on a regular basis. The savings will be long term as the military airlift community is able to recover from a decade of extremely high operations tempo and the airlift hardware lasts longer than (or at least as long as) planned.

The air carriers excel at moving large amounts of people over long distances. Their equipment was developed and procured to be a mass people mover. They are very good at that job. The military aircraft, designed to move large and bulky equipment can not compete with the efficiency of the air carriers. Rather than compete, the Department of Defense should use this asset (CRAF) to their advantage and couple this capability into day to day movements.

Standard cargo that fits on pallets may be closer to a draw, but there are a few examples to study. Generally, it is more efficient to move complete planeloads, rather than partial loads. While this makes economic sense, the military does not always have the luxury of waiting for a full load. Situation and mission requirements may dictate otherwise. Air carriers charge a higher fee for less that full plane loads and for one way trips. Consideration must be given to each situation.

The first example to address is the movement of bulk cargo, 18 pallets. Both the C-5 and C-17 move this amount in one aircraft, a C-141 requires two. The air carriers will increase the fee for this shipment since it is well below typical plane load volume. Another example to study is the movement of 45 pallets of bulk cargo. It takes 4 C-141, or 1 C-5 and 1 C-141, or 2 C-17s and 1 C-141 to move the cargo (see Table 2, Appendix A). The

typical air carrier (MD-11, DC-10, B-747-400) carries the entire load in a single aircraft. This is a very lopsided comparison economically speaking.

The movement of outsized equipment is a very lopsided comparison on a physical scale. There are no civilian assets that can move a main battle tank. Either the C-5 or C-17 can carry a single tank over great distances, anywhere with AAR. The C-17 even has the unique ability for "tactical" delivery of a strategic shipment. With the short take-off/landing (STOL) capability of the C-17, most cargo can be delivered to runways that do not support C-5 or civilian cargo operations.

If strategic AAR assets are extremely limited (another contingency or MRC being executed), then the inherent unrefueled range of civilian aircraft may be the best answer, regardless of cost. It is situation dependent, but there are various times when routine and continuous use of the CRAF will benefit the Department of Defense.

Notes

[1] Routh, Wes, LtCol, USAF, HQAMC/DOF. "Introduction to the Civil Reserve Air Fleet." Briefing notes, page 22.

[2] Huegen, Dale, GS-14, Supervisory Price Analyst, Contracting Division, Directorate of Logistics, HQAMC. *Commercial Airlift Rate Making,* December 1996, briefing notes, page 55. The objectives of this program are to optimize CRAF participation and maintain reasonable rates for industry. The standard rate that is settled upon is used for both peacetime and CRAF mobilization, should that occur. The current (1995 MOU) rate is 6.663 cents per seat mile and 25.854 cents per ton mile.

[3] Routh, Wes, LtCol, USAF, HQAMC/DOF. "Introduction to the Civil Reserve Air Fleet." Briefing notes, page 5. LtCol Routh's notes say that the total cost of the CRAF activation for the Persian Gulf Crisis was $1.35 billion and that the cost to maintain an equivalent military fleet would have cost many times this amount.

[4] May, Bedford D., LtCol, USAF. "The Development of the Civil Reserve Air fleet by the Department of Defense, an Analysis." Thesis number 2555. Maxwell AFB, AL: February 1964, page 56.

[5] Routh, Wes, LtCol, USAF, HQAMC/DOF. "Introduction to the Civil Reserve Air Fleet." Briefing notes, page 5.

[6] US Department of the Air Force. *Air Force Executive Guidance,* Washington D.C., updated October 1996, page 15.

Chapter 5

Conclusions

> *We will do whatever it takes to defend these (vital) interests, including—when necessary—the unilateral and decisive use of military power.*
>
> —William J. Clinton, President

This paper shows routine use of the CRAF is a viable option for the USAF to supplement airlift operations. In this time of drawdowns and doing more with less, CRAF is an option that can be effectively used on a day to day basis. The efficiency of the commercial air carriers was heralded during the first and only implementation of the CRAF, supporting Desert Shield and Storm.

There were some bugs with the system, but the execution of the plan to implement CRAF changed very little from the planned uses. Using CRAF on a routine and continuous basis further streamlines the process and improves the coordination of assets. The Department of Defense gains a viable cost saving measure to meet our current requirements, while decreasing the operations tempo of our critical strategic airlift assets.

It seems odd to have civilian airlift assets accomplishing strategic missions, while USAF strategic airlifters sit by idly waiting. The "idle" time would not be wasted. Flying units need time to accomplish ground training and to perform maintenance on the aircraft. Implementation of the CRAF as proposed by this paper provides a minimum break for the airlift community to catch their breath by reducing their operations tempo.

Senior Air Force leaders support measures that improve the troops quality of life, as long as the mission is still accomplished. Decreasing the operations tempo of a critical asset is one of these improvements, but there are drawbacks to this type of improvement. The mission would still be accomplished, in accordance with the 1987 National Airlift Policy which:

> reinforced the United States military plan for using commercial airlines wherever suitable and feasible. The policy is to fly military aircraft during peacetime the minimum necessary to maintain military readiness and training and to rely on civil carriers to meet the remaining airlift requirements where possible.[1]

Typical training for the airlift mission is very similar to that of the mission during combat operations. Moving vast amounts of supplies and people long distances to foreign countries is great training for airlift aircrews. The flight hours accumulated on the USAF strategic airlift fleet is impressive. But the aircraft will be around much longer if flight hours are accumulated at a slower pace. In essence, this would be similar to purchasing another fleet of airlifters at about the time when the new fleet would be retiring.

Today's current procedures for arriving at the negotiated price should not change. Increased use of civilian assets and a stable rate of use will provide enough incentive for civilian companies to continue to support the CRAF.

The negotiated costs per MTMs civilian assets are paid today for excess airlift requirements include aircraft depreciation. There are no hidden costs to increasing the output on the civilian fleet. Using the CRAF on a routine and continuous basis will not hinder the DOD from using it in the future. The base for CRAF may actually grow, as companies see a business opportunity.

If USAF strategic assets are receiving help to accomplish the mission, the military fleet will last years longer. Additional flight hours are added to the commercial fleet. If an aircraft is designed to fly 20,000 hours over a 25 year period, decreased demand allows that same 20,000 hours to be stretched over 30 years or more.

The ability to move passengers in comfort and large quantities of palletized cargo vast distances without AAR support is the strength of the CRAF. We need to tap into that strength on a day to day basis. It will reduce the operations tempo on two strategic assets, both the airlifters and aerial refuelers, while still accomplishing the mission. Costs to the tax payer will not increase, and over the long run may even decrease. Routine and continuous use of the CRAF provides the USAF with another opportunity to do more with the same.

Unilateral and decisive use of military power require vast amounts of strategic lift. Strategic airlift is but one part of the strategic lift equation. Today's strategic environment requires "Rapid Global Mobility" to ensure decisive force is deployed and can be sustained, without requiring the support of other nations. The shooters know the best way to train is to train the way you fight. Our strategic airlift requirements rely heavily upon the capabilities of the CRAF. Should we wait until the next large contingency to "train" with that asset again?

Notes

[1] Routh, John W., LtCol, USAF, Deputy Chief, Civil Air Division, Directorate of Operations, HQAMC. "Introduction To The Civil Reserve Air Fleet." Briefing notes, December 1996, page 4.

Appendix A

Table 2. Aircraft Comparison

	C-141[1]	C-5[1]	C-17[1]	DC-10[2]	747-400[3]	MD-11[2]	B-767[3]
Min Rwy	9,000	13,600	7,760	11,850	9,700	9,500	N/A
Max # Pallets	13	36	18	35	46	45	24
MTM/D	.066	.1507	.146	.1307	.1911	.1375	N/A
Throughput[4] (Tons/day)	492	481	963	800	585	842	N/A
Max (lbs) Payload	89,000	261,000	169,000	179,700	248,000	196,928	118,000
# Troops w/no mod w/pax pal	 160 140	 73 270	 102 154	 0 75	 0 266	 0	 0
Med Evac	Yes	No	Yes	No	No	No	Yes
Oversize Cargo	Yes	Yes	Yes	Some	Some	Some	Some
Outsize Cargo	No	Yes	Yes	No	No	No	No
Airdrop/ Number	Yes 155	No	Yes 102	No	No	No	No
Direct Delivery	No	No	Yes	No	No	No	No
AAR	Yes	Yes	Yes	No	No	No	No
Rng w/o AAR	2174 NM	5940 NM	5200 NM	5800 NM	7,200 NM	7,200 NM	3,760 NM

Notes

[1] USAF Fact Sheet (available from http://www.usaf.mil) and *Strategic Airlift: Military Versus Commercial Aircraft*, Terry, Sanford S, USAF National Defense Fellow, Foreign Affairs and National Defense Division, CRS Report for Congress, May 94, page 6.

[2] McDonnell Douglas DC-10 Fact Sheet (available from http//www.md.com) and *Strategic Airlift: Military Versus Commercial Aircraft*, Terry, Sanford S, USAF National Defense Fellow, Foreign Affairs and National Defense Division, CRS Report for Congress, May 94, page 6.

[3] Boeing 747-400 Freighter (available from http//www.boeing.com) and *Strategic Airlift: Military Versus Commercial Aircraft*, Terry, Sanford S, USAF National Defense

Notes

Fellow, Foreign Affairs and National Defense Division, CRS Report for Congress, May 94, page 6.

[4] Terry, Sanford S, USAF National Defense Fellow. *Strategic Airlift: Military Versus Commercial Aircraft*. Foreign Affairs and National Defense Division, CRS Report for Congress, May 94, page 6. Throughput based on 24 hour/day operations, initial airfield constraints at Mogadishu, Somalia.

Appendix B

Table 3. International Passenger Fleet

Company[1]	WBE Offered	Percent of Fleet	Percent of CRAF
American	47.12	100	23.22
Northwest	46.17	81	22.76
United	31.84	30	15.69
Continental	14.81	100	7.30
Delta (7.4 WBEs for AE)	12.98	30	6.40
TWA (4.04 WBEs for AE)	12.83	60	6.32
Tower Air	12.76	90	6.29
American Trans Air	10.49	100	5.17
Total Passenger[2]	185.54		
Total Aeromed	17.06		

Table 4. International Cargo Fleet

Company[3]	WBE Offered	Percent of Fleet	Percent of CRAF
FedEx	48.68	100	31.23
American Int'l	15.11	98	9.69
Polar Air Cargo	14.46	100	9.21
Emery	13.84	100	8.88
Evergreen	12.43	100	7.98
Atlas Air	9.85	50	6.32
Northwest	9.26	100	5.94
Total WBE Cargo[2]	155.86		

Notes

[1] Routh, John W., LtCol, USAF, Deputy Chief, Civil Air Division, Directorate of Operations, HQAMC. "Introduction To The Civil Reserve Air Fleet." Briefing notes, December 96, pages 74-75.

[2] Only companies that provide 5 percent or more of the CRAF capabilities are listed.

[3] Routh, John W., LtCol, USAF, Deputy Chief, Civil Air Division, Directorate of Operations, HQAMC. "Introduction To The Civil Reserve Air Fleet." Briefing notes, December 96, pages 76-77.

Glossary

AAR	Air to Air Refueling
AE	Aero-medical Evacuation
ALPA	Airline Pilot's Association
AMC	Air Mobility Command
BURU	Bottom Up Review
CINC	Commander in Chief
CRAF	Civil Reserve Air Fleet
DOD	Department of Defense
DS/DS	Desert Shield/Desert Storm
LAPES	Low Altitude Parachute Extraction System
MATS	Military Air Transport Service
MHE	Material Handling Equipment
MOG	Maximum On Ground
MOU	Memorandum Of Understanding
MRC	Major Regional Conflict
MRS	Mobility Requirements Study
MTM/D	Million Ton Miles per Day
NMS	National Military Strategy
POD	Point of Debarkation
SOF	Special Operations Forces
STOL	Short Take-Off/Landing
Ro-Ro	Roll on, Roll off
TRANSCOM	Transportation Command
USAF	United States Air Force
WBE	Wide Body Equivalent
WMD	Weapons of Mass Destruction

million ton miles per day. Planning factor based on aircraft utilization rate, block speed (average ground speed), average payload weight and a standard productivity factor.1

outsize cargo. A single item that is air transportable and exceeds 83.3 feet (1,000 inches) in length, 9.75 feet (117 inches) in width, or 8.75 feet (105 inches) in height in any one dimension.

oversize cargo. Items that exceed the useable dimensions of the 463L pallet and can be up to 90.8 feet (1,090 inches) long, 9.75 feet (117 inches) in width, and 8.75 feet (105 inches) high.

pallet. A standard 463L pallet measures 88 inches x 108 inches. The pallet is designed to be loaded to 96 inches high.[2] Any cargo that does not fit within these dimensions is oversize or outsize cargo.

throughput. A function of three major factors: aircraft cargo capacity, the maximum number of aircraft capable of being on the ground at a specific location (MOG), and the time needed to service each aircraft on the ground.[3]

wide body equivalent. A factor based on the cargo capacity of an aircraft, when compared to a baseline aircraft (747-100).

Notes

[1] Terry, Sanford S, USAF National Defense Fellow. *Strategic Airlift: Military Versus Commercial Aircraft.* Foreign Affairs and National Defense Division, CRS Report for Congress, May 94, page 2.

[2] Ibid., page 3.

[3] Ibid., page 2.

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